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ABSTRACT

This paper is concerned with technology as an area of study in education and how children might learn about technology. The curriculum strategy is intended to help the student gain the skills needed to enable him to earn his way in society, to understand his part in the work force, to understand how technology affects his life, to try out tentative career directions, and to find out about his skills, abilities, interests, beliefs, and values as they apply to technology, the "world of work", and "self." At first, the child will study jobs that are thing-centered or people-centered, then jobs that are product-centered or service-centered. In other words, he will classify jobs according to this continuum. During 3 years the student can study within the major subdivisions of technology, which are communications, construction, manufacturing and service. Also, he will have the opportunity to work within a small student-directed company so that he may apply his knowledge. (Author/GEB)

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A WORKING CURRICULUM PAPER ON TECHNOLOGY AND THE WORLD OF WORK AND CAREERS

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This paper is concerned with technology as an area of study in education and how children might learn about technology. Our attention will not be given to technology as a means of supporting the classroom teacher by the use of such devices as the computer and audio-visual aids but will be turned to technology as a body of knowledge that is worthy of study. The writer has attempted not to revere technology as the source of answers to all of man's pressing problems nor to castigate it as the source of all those problems. The paper is simply a straight-forward attempt to discuss how children might learn about technology and some of its important elements and consequences.

The following curriculum strategy addresses itself to that task. Stated simply, the purposes of this curriculum are that each student sometime before graduation be able (1) to gain the skills needed to enable him to earn his own way in our society, (2) to see the part he may play in the work force and the significance of that work, (3) to try out tentative work interests and career directions with a minimal threat of failure, (4) to comprehend how technology effects his life and how he may gain skills in controlling certain aspects of that technology, and (5) to find out about his skills, abilities, interests, beliefs, and values as they apply to technology, the "world of work" and "self."

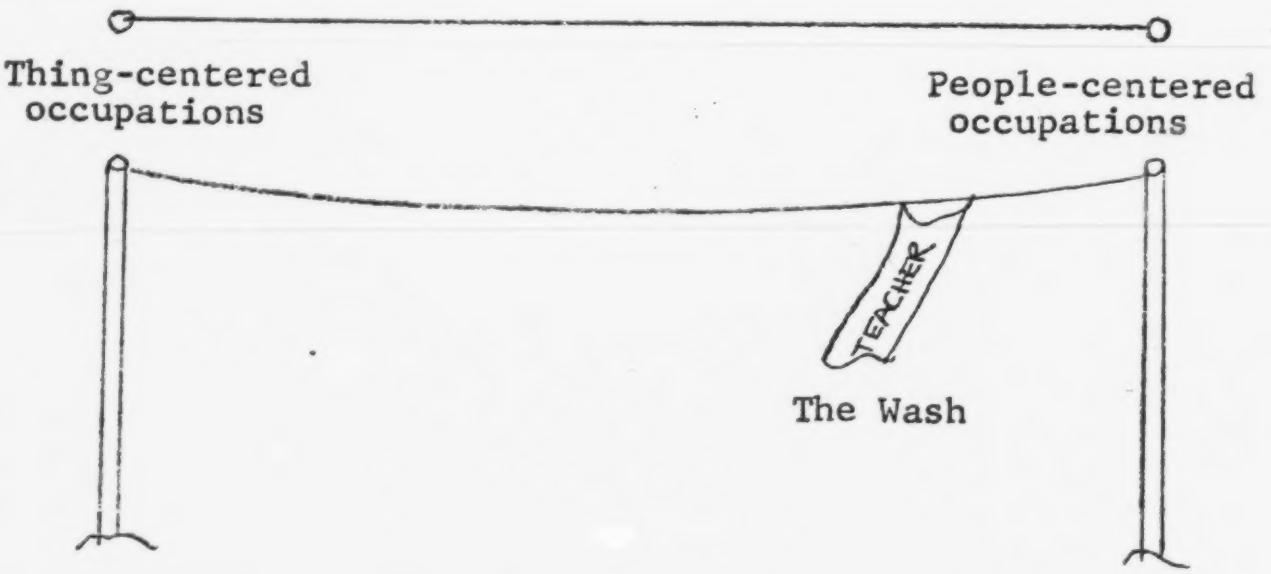
Underlying the curriculum that would fulfill the above purposes are several assumptions upon which this work is based. First, there is a growing body of knowledge which provides us

with insights into how children learn, gain attitudes, and develop skills. Second, children can understand a great deal about the "world of work" and technology. Third, children can be helped to gain insights into "self" and to understand social and group relations. Fourth, many learning activities in all areas of study may lose much of their potential impact because of a lack of coordinating themes. Fifth, the study of technology and the "world of work" can provide some of these coordinating themes.

Primary consideration will be given to assumptions four and five for without themes or other organizing devices the child's classroom experiences become unrelated activities important only in and of themselves. For example, children come into contact both in school and at home with a great deal of information about people at work. They read about community helpers, about life in other countries, and how products are made. They go on field trips, see films, and watch an incredible amount of television. Much of the impact of these events is lost, however, if the child does not know what to consider as important. In most cases he has no conceptual "tools" for seeing what is important. A child does not normally see how such experiences and concepts relate to him. The problem as seen from the child's point of view is how to make sense out of the myriad occupations and types of work that he learns about in school and that are brought to his attention in and out of school. The curriculum strategy to be developed in this paper is designed to assist the learner in making sense out of these experiences.

What type of conceptual "tool" can be provided that will allow the elementary child to make sense out of what he has experienced? The tools the child is going to use should be comparable in simplicity to a hammer or a pair of scissors. They must allow and assist the child to identify similar jobs and technological activities, to identify the nature of the similarities, and to put what he has learned into some meaningful pattern.

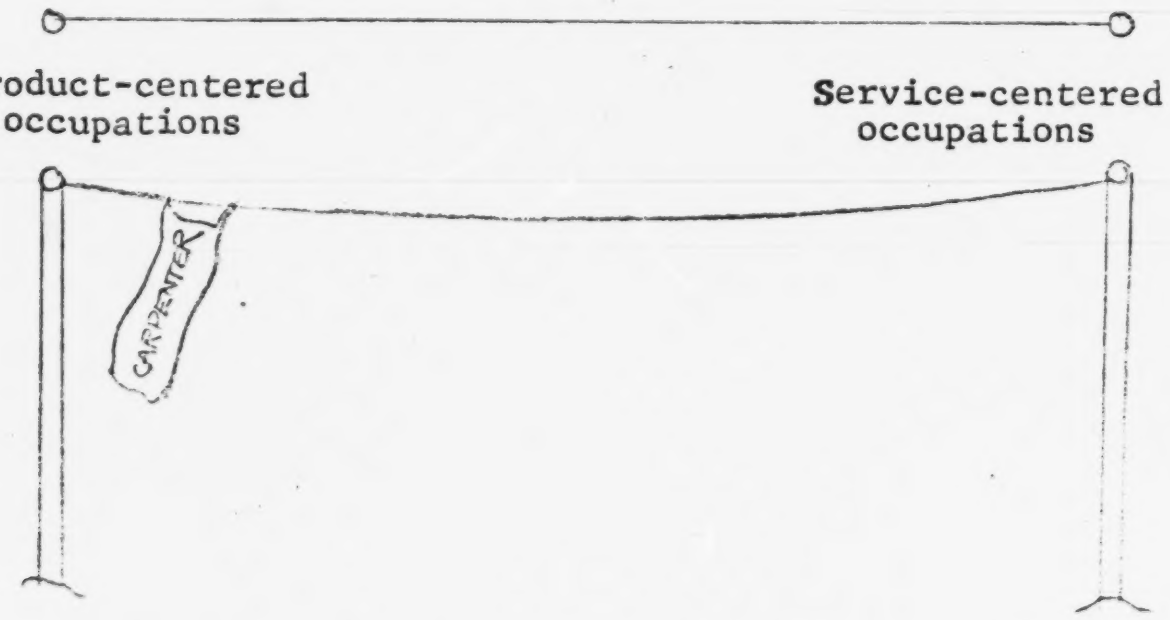
The diagram below shows the first elements of the strategy and is a paradigm of what the elementary child might use as a tool. On the clothesline paradigm the child will hang the names of jobs and occupations much like the week's wash. The child at first may place the early titles of jobs on a real line. Later, of course, such activities would become covert.



Initially the child would come into contact with jobs that can easily be classified in terms of being thing-centered or people-centered. A variety of methods could be used to include role playing. Playing school or building things out

of cardboard could help to spotlight teaching and carpentry. Teaching, for example, is more people-centered than carpentering. Carpentry is more thing-centered but neither of these two occupations should be considered as purely one or the other. Later on the child will be able to make closer and closer discriminations and will be able to arrange a variety of jobs along that line, or continuum, of thing-centered to people-centered activities. Hopefully through his increasingly greater discrimination ability, the child will learn how to identify jobs that may initially appear to be half thing-centered and half people-centered.

Shortly after the child becomes comfortable with the first element, which we have called a conceptual tool, a second tool may be introduced. It is quite similar to the first--although somewhat more abstract. The diagram below shows that similarity.



The ideas offered in this diagram are product and service. For the sake of clarity we refer to these ideas as product-

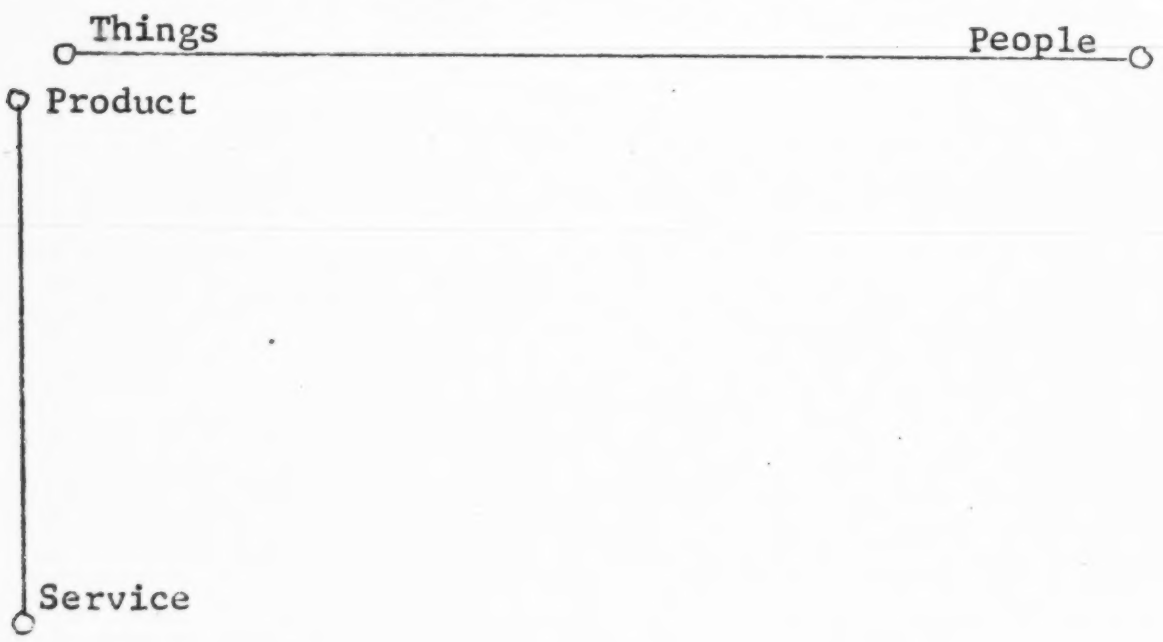
centered and service-centered activities. The child now has a new set of classifications to complete. On reclassifying the jobs of teacher and carpenter, he would see the teacher as service-centered and the carpenter product-centered. Again, neither one of these jobs would be placed at an extreme end of the line since neitheris purely one type of activity.

The child is helped to continue reclassifying the jobs he has previously studied in terms of this new continuum. Subsequently, new jobs that are studied can be placed on both of the lines. The minimum expectation of this long-range strategy is that, by the time the child leaves the elementary level and moves to the middle-school or junior high school, he should be able to place a wide variety of jobs and occupations on the correct section of the thing-person line and the product-service line. It is not important, however, that all children be able to make minute differentiations between closely related jobs. It is important that they begin to understand similarities and differences between jobs and how they might like certain aspects of these work activities and not others.

At this point an example of the activity that children might experience may serve to clarify some of the points made above. The writer staged a simulation of an assembly line in an elementary classroom. Although the total unit took only one hour, certain manipulative, organizational, analytic, and leadership jobs were readily undertaken by the pupils. The simulation was staged so that many of the youngsters could talk about what they liked and disliked about these quasi-industrial

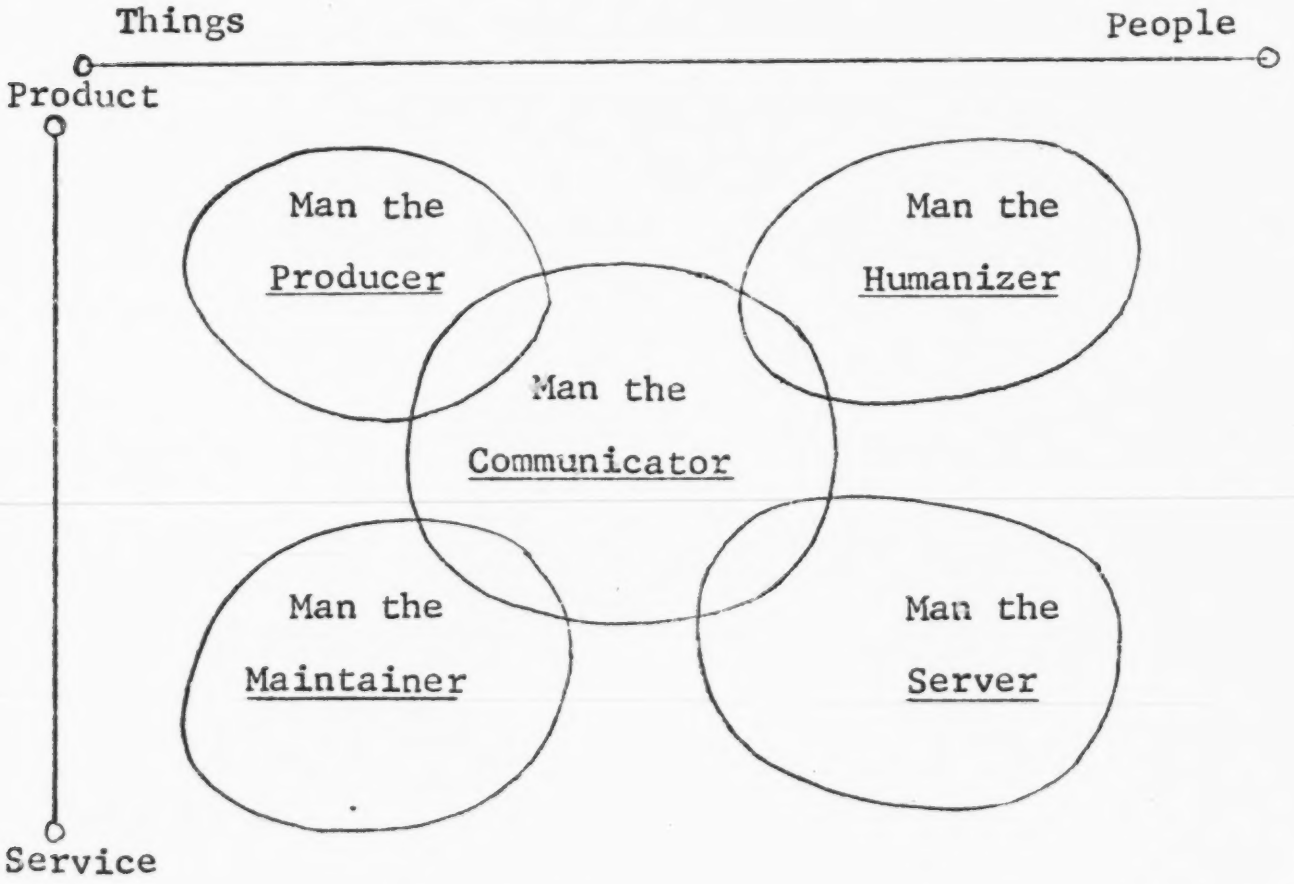
jobs and activities. Dislike was included, as certain pupils were very quick to indicate their discontent at doing a simple task, such as attaching one part, over and over again. The pupils could then look at the jobs they had assumed in the simulation and classify them as one of thetwo choices on each of the lines. Perhaps even more importantly, the pupils could compare at a rudimentary level some of the aspects of these jobs to their own likes and dislikes and know where they stand as a result. Thus, in this case as in others, a secondary value is self-knowledge for the student.

If by this time the pupils have gained a minimum of these two conceptual tools, they will possess the necessary know-how with which to build a model of the world of work. The framework of the world-of-work model constructed from those first tools to form a two-dimensionsal model as shown below:



In the middle-school program a plan can be employed to put jobs in a new perspective in the eyes of the student. Job roles are now experienced when students explore and act out

simplified activities drawn from the world of work. Now through man's major activities in the world of work students are helped to find relationships between old familiar jobs as well as many new ones. These major relationships will emerge as the students continue to plot the jobs and occupations they are experiencing in the middle-grades program. Their resultant model of the world of work will ultimately take on an appearance similar to the diagram shown below:



On inspecting the above model it is possible to see that one who works with things will, at least initially, be viewed as man the maintainer. As they work with or generate different kinds of information, students will become communicators; and as they provide service to others, they will become servers. As a producer students may work as carpenters, bakers, machine

operators, tailors, and so on. As maintainers they may work as painters, welders, seamstresses, mechanics and the like. Secretaries, computer operators, actors, and designers, to name only a few, are job roles within the area of man the communicator. Man the server takes in all the occupations that support or maintain man directly. Students may play such roles as doctors, lawyers, domestic helpers, and teachers in this category. The last category, man the humanizer, includes the jobs and roles which develop and assist the individual. The occupations of mother, father, industrial designer, and perhaps the teacher belong in this group.. It would hopefully become evident to the student that the lines between each of the categories is not clear cut and distinct for certain jobs may be placed in more than one major grouping. It is important that the student see that people who can move from one group to another have a range of capabilities in being able to work with things, people, and with ideas.

Grouping many jobs and experiences into clusters is not the primary goal of the strategy at this junior high school level. The potential of the model begins to show when the individual is able to use it like the clothesline. This model takes on attributes that are similar to a combination window and mirror. When he uses it as a window, the student can observe the real world of work and interpret new activities in terms of the categories of work that man does. If the model is used as a mirror, the student is aided in comparing himself

or 'self' to certain others in a variety of work roles. The student who prefers not to work with people, for example, will find that a large number of occupations he may have thought interesting actually may well be frustrating to him in reality. If a student has become interested in working in a simulated bakery, he may be helped to decide that he must do something about his tendency to postpone things or to be late, otherwise he may be unsuccessful as a producer who must have his goods ready on time.

Through using the mirror-window model the student can see that although some jobs are not well suited to him they still represent worthwhile endeavors. The child's attitudes toward different kinds of work and workers are constantly explored. He can be helped not only to expand his concepts of what jobs are possible for him but also to appreciate the worth of the work of others. This is especially important during that period of time during junior high school when many students seem to be ready to explore and search for commitment toward some form of adult work-role.

Such activities as the simulation and role-playing described earlier can help to add relevancy to this search as well as to add significance to the study of social science, mathematics and other areas through active participation in problems. Involvement through fantasy, simulation, and role-playing can motivate students and provide an effective learning environment. These same types of activities can assist the student in uncovering some of the interrelationships between information and concepts from other areas of study as well as his own interests in and attitudes toward those activities.

The matching of the student's abilities and interests to certain jobs and activities has several advantages. If the student dislikes some of the activities, it is possible at this early point for him to begin asking why. It is also important that the student see some of the consequences of this matching. If he or she dislikes working with people, the student can begin to predict the consequences of choosing certain kinds of careers. Alternatives can be explored until the student becomes aware of several possible careers in which he may experience less conflict between jobs and interests. The student may also be helped to identify why he has this dislike and what can be done to modify it if he so desires. It is possible also that the student may like a certain aspect of a job and lack a skill for the work entailed in the job. He may be helped very early to see how jobs come together in clusters and consequently find a different but related job that is of interest to him and suited to his abilities. Identifying alternatives for choices of action and direction is an important secondary characteristic of the curriculum strategy.

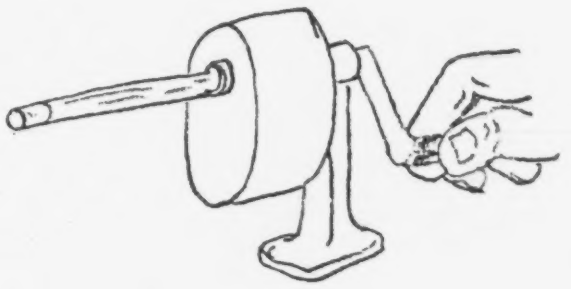
The student by the time he has entered high school will have gained insights into the jobs people hold and where these jobs fit into the world of work. This level of understanding will not prepare the student to comprehend fully what the worker actually does or what takes place in the social institutions of industry, business, medicine, and other technologies. Comprehension at this more sophisticated level will require

additional conceptual tools and more involved learning experiences. The student will gain some of these tools through a set of interrelated activities called the Elements of Technology. These analytic tools will assist the student in looking at technological phenomena--what the worker does or is involved in--with new insights.

Any technological phenomenon, from the simplest to the most complex, is composed of six basic elements. Operating an atomic pile and sharpening pencils are to some extent similar, for each phenomenon is composed of materials, processes, machines, energy, information, and man. Below is a diagram of the six elements and a simple paradigm about sharpening a pencil. This phenomenon can be broken down in the following manner. The sharpener itself is composed of several materials and through a simple process of cutting removes material from the unsharpened pencil. The materials in the sharpener are

ELEMENTS OF TECHNOLOGY

MATERIALS
PROCESSES
MACHINES
ENERGY
INFORMATION
MAN

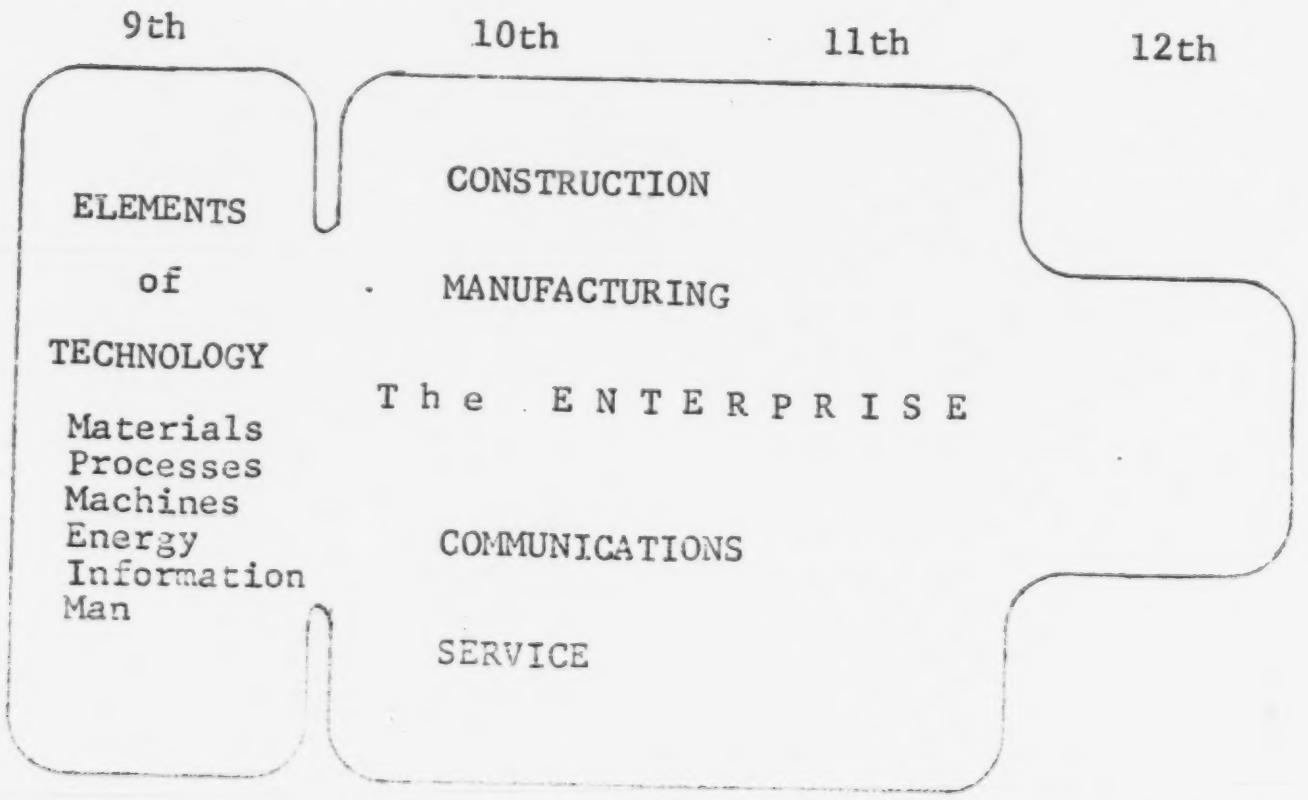


put together to make a machine, namely the sharpener. Energy is supplied by the person turning the handle. The information exists as the feedback through the individual's fingers and through his eyes as he visually inspects the point. More

sophisticated technological phenomena may have to be broken down through several stages until they can be handled in the same manner as the sharpener.

The student may be introduced to the Elements of Technology through a variety of techniques. They may read about, observe, simulate, and stage different technological phenomena. For example, a class of ninth graders, through utilizing the six elements, may set up a conveyor or make parts for a manufacturing line designed by older students. In this way they will have concrete experiences in finding out about different materials, machines, processes and the like as well as seeing how these fit into a larger picture.

The diagram below shows how the Elements of Technology would feed into the approach utilized over the last three years of high school. Again, as before, there is continued



emphasis on interrelating experiences and self to the areas of study. During these three years the student will be able to study within the four major subdivisions of technology, namely communications, construction, manufacturing and service, and to relate these areas to the basic elements of technology he has studied earlier.

At the same time the student is studying in one of the areas of technology, he may wish to work within the Enterprise. The Enterprise, a small student directed company, operates as a product or a service producir organization and is located in the school facilities. The Enterprise serves as a vehicle for attaining several distinct ends: (1) The Enterprise provides a place where students interested in business can experience directly what some of the problems in business are like. (2) It provides all students with the opportunity to find out what it is like to work within a larger and more diverse group rather than merely a single class. (3) It binds together the work of many different students as they attempt to reach some common goals, such as producing a product. (4) The Enterprise, lastly, helps to extend the continuity of student work beyond the end of the school year into the next year and even further. This last capability provides the teaching staff a much needed long-range scheme around which to plan. For example the teacher may encourage a particular student to take on a specific project because he knows that there may be a good possiblity that a class or a group of students may continue that work the following year.

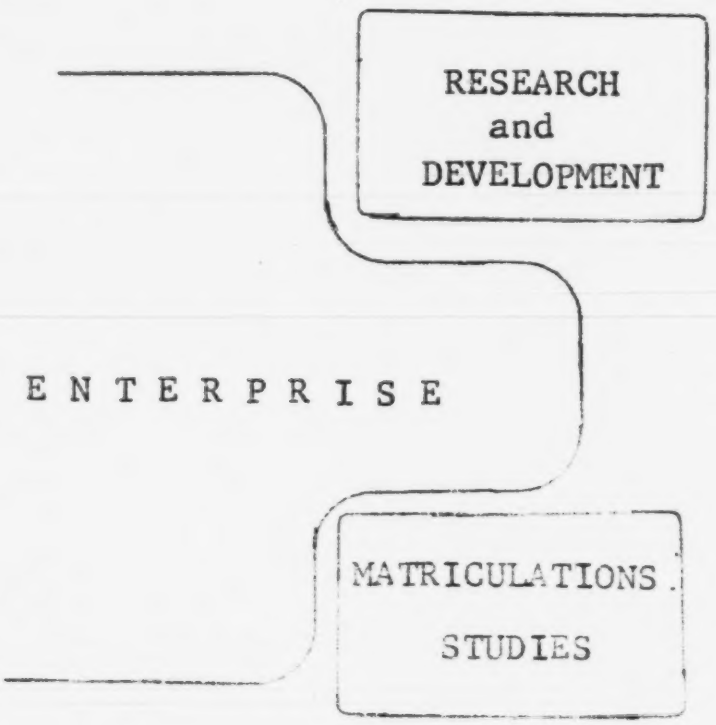
Besides gaining manual skills in an area of interest, the student in the Enterprise lives through some of the organizational types of problems that he will face when he enters business or industry. It is not necessary to tell him that a position of responsibility has both advantages and disadvantages for he will find this out in his work within the Enterprise. It is not necessary for students to take someone else's stand on management or labor for we will see some of the reasons for or against unionizing and some of the difficulties of negotiating himself. In the experience of the writer, students invariably explore the role, function, and requirements for a union as well as the need for it. After all this, they sometimes remain an open shop and other times choose to unionize.

The Enterprise includes some aspects of the four technologies--communications, construction, manufacturing, and service, but there are some non-enterprise aspects of technology studied as well. In the study within the Enterprise, concern is placed on the problems that exist within that particular technology as a part of the functioning company. In the non-enterprise aspects, the major focus is on the in-depth study of the technology itself. Both of these are mutually supportive. Problems worth studying will emerge from within the Enterprise, and the in-depth study of those technological problems through the students individual work can be used by the teachers to improve the Enterprise.

The Enterprise itself includes all the problems of establishing, maintaining, and improving a company and consequently places new demands on what the students does and what he learns.

Students now must supply a wide range of abilities and talents for jobs within the Enterprise. By taking roles in the Enterprise the student has the opportunity to try out jobs and professional roles as an important part of career planning. The student may want to take over the responsibility of a higher-eschelon position or he may want to perform within a speciality while working under someone else. In this way the Enterprise and the four technologies would provide for many different interest patterns.

There are, however, two groups of students whose interests may extend beyond the curriculum as it has been presented up to this point: (1) those students who may plan to enter the labor market immediately upon graduation and (2) those who are interested in occupations that are more white collar or scientific in nature. The diagram below illustrates graphically where the program attends to these two groups. The student



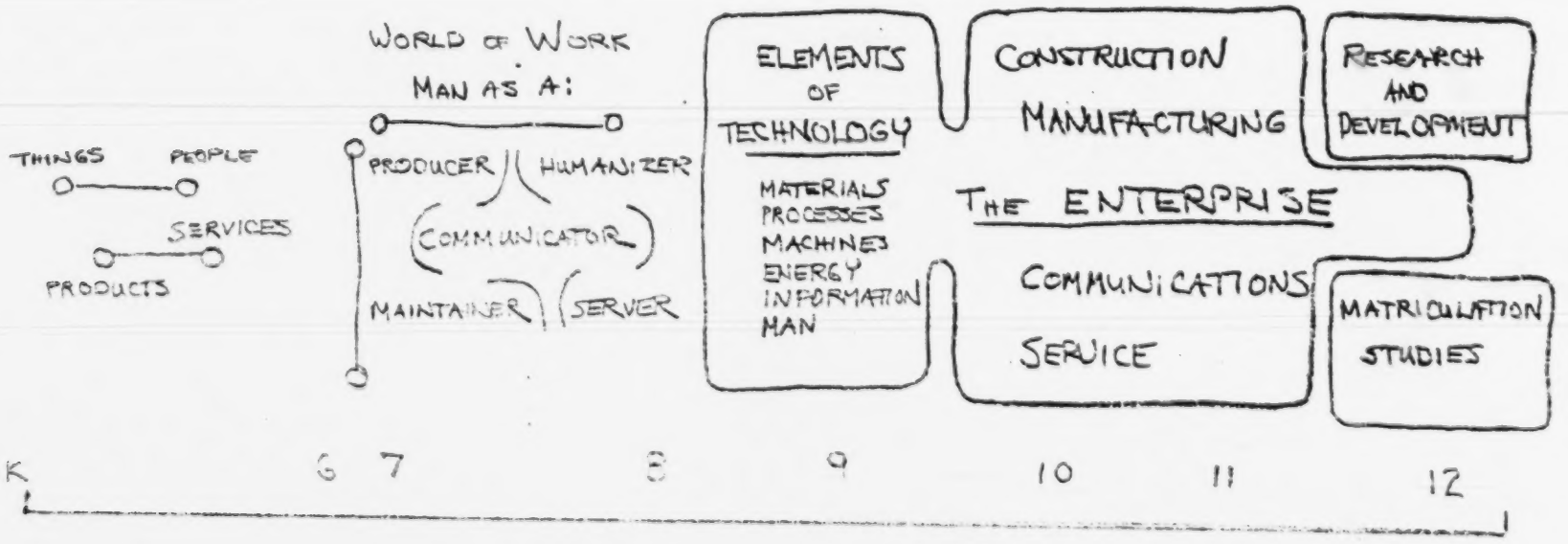
who wishes to enter industry or business upon graduation needs an individually tailored program that will allow him to utilize previous experiemces in clarifying the area in which he plans to work in the real world. This will by necessity require a cooperative effort from business, industry and the school. This does not mean, however, that the student will be transferred to a business or industry for his last year of education. The student will be helped to use and extend his analytic skills in breaking down his new job in a manner similar to his earlier work in junior and senior high school. He will analyze his job into its components and then begin a series of tests and skill matchings to spot his areas of strengths and weaknesses as they relate to that new job. The new trainee will also have the responsibility of sharing his findings with his schoolmates. In many cases his work willbe directly related to or supportive of the Enterprise. The other students will work with him to discuss and predict possible trends that may occur in his new career direction as it might change in the future.

The last element of the strategy is the area of research and development, or R&D. R&D provides the capability of allowing students who are interested, to study professional, scientific, and technical problems in depth. These problems, which may grow out of science, language, mathematics, and other areas of study, would be staged in the R&D laboratory. We are familar with the variety of interesting work done by students as they compete in science fairs. Although much of this work is usually

done at home, individual study and investigation of this nature provides an excellent in-school vehicle for learning.

Many problems that are usually tackled in R&D grow out of the myriad of situations that arise from within the Enterprise. For instance, let's say a process does not work as well as it should, a different machine is needed in a production line, a conveyor system is meeded. A control, a network, or a system may require in-depth study and development. In this way meaningful problems can be uncovered that would fit a wide variety of student interests. R&D also provides the teaching staff with a source of talent and time to solve problems that arise--thus the Enterprise and the curriculum may become self-sustaining. In this manner the students share in the responsibility for supporting and improving their company and the long-range plan for future students.

Up to this point you have seen the different levels and parts of the overall curriculum. The diagram below is offered as a graphic summary of that total program.



While this paper has discussed a possible curriculum strategy and some of the student activities within that curriculum, space does not allow us to discuss all the possibilities of those activities or the myriad of activities that could grow out of the different levels of the curriculum. In an attempt to show some of the potential of the curriculum, a scheme of learner behaviors that the curriculum addresses itself to is presented below:

CONTENT

BEHAVIOR	Information	Skills	Values
The student upon graduation will be able to:			
Cognitive	Comprehend: how people get their work done; how organizations operate; what knowledge is needed in a career plan and what is his interests and capability	Comprehend: the variety of skills needed in the "World of Work," the wide range of individual skills and their merit, the importance of enhancing skills--creative, analytic and performance.	Comprehend: the importance of beliefs and attitudes in one's work and career; the different values of others; when the values of the individual adds to or detracts from the "self."
Psycho-Motor	Utilize: the vast store of information through the identifying and retrieving existing dataand information in producing new data in his work and study.	Gain: some skills in the wide range of manipulative skills available; analytic, creative and aesthetic ones to some extent and particularly in his interest areas.	Act: in accord with his beliefs and attitudes toward work skills and others; in ways which will help him gain skills or knowledge supportive to his beliefs.
Affective	Respond: to the vast quantity of knowledge both sound and unsound; in appropriate ways to propaganda, indoctrination and other misleading information.	Receive: and accept the skills of others as worthwhile contributions; others as participating and productive members of the work force with their special talents and skills.	Internalize: a set of values and beliefs about "self", work, careers, and others that will enhance himself and support similar kinds of growth in other people.

The diagram above attempts to describe the outcomes, in terms of the change in students, that may be produced by the curriculum discussed in this paper. The chart shows how the three types of content interrelate with the three types of processes. The nine statements that emerge from this interrelatedness indicate what the student will hopefully learn upon the completion of the program. In that only parts of total curriculum have been implemented, it is impossible to substantiate the plan with empirical data. At this point the plan remains a curriculum in search of other potential users.

To suggest that children have a difficult time in becoming prepared for the technological world in which they will live and work is perhaps to state the obvious. Technology as an area of study has been somewhat neglected in the past by school people. One could legitimately question whether the schools have been neglect by not making available to all students some form of program that attends to the understanding of technology. This paper has described one approach through which students might learn more about themselves, possible career directions, the world of work, and the area of technology.